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Meadow vegetation in the montane region of northern Colorado

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(WITH ONE TEXT FIGURE)

The meadows here considered are chiefly those of a mountain park, Boulder Park, at Tolland, in the montane region of northern Colorado, at an altitude of 2,710 m. Reference is also made to some meadows at lower altitudes, likewise to some of the subalpine region.

Boulder Park (FIG. 1) is a small treeless valley about 3.2 km. long by 1.2 km. wide, surrounded by hills covered with forests of



FIG. 1. View of Boulder Park (Tolland, Colorado) looking west to the Continental Divide. Meadow vegetation is developed along the Creek, around the ponds and on certain hillsides, especially above the lake at the right of the picture. Photograph by Dr. G. S. Dodds.

conifers and aspens. South Boulder Creek flows in a winding course through the length of the park. The floor of the park is covered with glacial drift in the form of morainic knolls and sinks and flat terraces formed by a rearrangement of the glacial deposits through the action of running water. Drift material is also present

on the lower parts of the surrounding hills. The vegetation of the park forms itself naturally into the following communities: sedge moor, willow scrub, meadow, and dry grassland (see Ramaley, 1). The mesophytic portion of the grassland, which is characterized by meadow grasses, sedges, and flowering herbs closely set so as to expose very little bare ground, is here termed meadow. It is with the meadow vegetation primarily that the present paper is concerned. The meadow association occurs along streams and around ponds, lying just above the willow scrub. It is bordered in turn by dry grassland or else by coniferous forest. The width of the meadow zone along streams is 1-10 m. or more, but there are hill-side meadows also, one in particular being about 300 × 600 m. in extent.

ENVIRONMENTAL FACTORS

The high altitude of Boulder Park and its proximity to the snow-covered peaks of the Continental Divide give it a severe climate. There is considerable snow in winter and frequent showers occur in spring and summer. The annual rainfall is thought to be about twenty-eight inches and the mean annual temperature 40° F. with a mean for July of about 58° F. The maximum temperature known for July is 82° F., and the minimum, 32° F. Scarcely a week passes without frost, while ice is formed frequently in July and August (see Ramaley, 2).

The soil of the meadows is a loose sandy loam two to ten decimeters thick. The subsoil is composed of coarse gravel. Determinations of soil moisture and temperature were made each season. The results are shown in TABLES I and II.

TABLE I

SOIL TEMPERATURES AT A DEPTH OF 30 CM.

July, 1915, average of twenty-three readings,	53.6° F.
July, 1916, average of fifteen readings,	56.4° F.

TABLE II

SOIL MOISTURE AT DEPTH OF 30 CM.

July, 1915, average of fourteen determinations,	16.7 per cent.
July, 1916, average of five determinations,	16.3 per cent.

By way of comparison it may be stated that the soil temperature of the dry grassland societies shows 64° F. for the July average

and that the soil moisture shows 4.6–9.1 per cent (see Ramaley, etc., 1, 2, 3).

SEASONAL ASPECTS

This study was carried on in 1915 and 1916 during two sessions of the University of Colorado Mountain Laboratory, extending from the last week in June to the first week in August. This embraces the summer season only, hence the spring and autumn aspects will be omitted.

Early summer is characterized by a profusion of flowers; grasses and sedges also are to be seen but they are not yet in bloom. The most conspicuous plants are *Thermopsis divaricarpa*, *Pseudocymopterus tenuifolius*, *Castilleia sulphurea*, and *Pedicularis Parryi*. The green of the foliage and yellow of the blossoms give the meadows at this time a yellowish green hue.

Late summer has a great profusion of flowering dicotyledons interspersed with grasses. The conspicuous plants in flower are *Campanula petiolata*, *Delphinium robustum*, and three species of *Potentilla*. These give the meadows either a bluish green or a yellowish green hue, depending upon whether the *Campanula* and *Delphinium* or the species of *Potentilla* predominate.

SOCIETIES

Owing to the varying conditions of moisture, differences in soil texture, and depth to subsoil, various societies may be distinguished. The genetic relationship of the several societies has not been studied. The following seem fairly well marked and with each a few species of the most prominent plants are given:

1. *Pedicularis-Pseudocymopterus Society*.—In certain of the drier portions of the meadows. *Pedicularis Parryi*, *Pseudocymopterus tenuifolius*, *Tium alpinum*, *Sieversia ciliata*, *Potentilla pulcherrima*, *Carex festiva*, *Festuca ingrata*, *Phleum alpinum*

2. *Thermopsis-Castilleia-Campanula Society*.—Characteristic of drier portions of hillside meadows. *Thermopsis divaricarpa*, *Castilleia sulphurea*, *Campanula petiolata*, *Bistorta bistortoides*, *Helianthella quinquenervis*, *Calochortus Gunnisonii*, *Allium Geyeri*, *Valeriana furfurascens*, *Festuca confinis*, *Phleum pratense*, *Stipa Nelsonii*, *Bromus Porteri*, *Danthonia Parryi*. This society has

two seasonal aspects: (a) early summer aspect with *Thermopsis divaricarpa* and *Castilleia sulphurea* dominant; (b) late summer aspect with *Campanula petiolata* dominant.

3. *Campanula-Eriogonum Society*.—This society is rather typical of the drier portions of the meadow especially that bordering on dry grassland. *Campanula Parryi*, *Eriogonum subalpinum*, *Galium boreale*, *Achillea lanulosa*, *Erigeron macranthus*, *Artemisia gnaphaloides*, *Stipa Nelsonii*.

4. *Pentstemon-Agoseris Society*.—This society is common in glacial sinks where the soil is deep and only moderately wet. A few invasions from the surrounding dry grassland are sometimes found. *Pentstemon procerus*, *Agoseris glauca*, *Valeriana furfurascens*, *Pedicularis Parryi*, *Achillea lanulosa*, *Potentilla pulcherrima*, *Mertensia Bakeri*, *Festuca pseudovina*, *Danthonia intermedia*.

5. *Potentilla-Fragaria Mixed Society*.—This society is typical of meadows along streams. There are no species that distinguish the society, but a number are present in almost equal abundance and the plants named are all well represented. *Potentilla pulcherrima*, *P. Hippiana*, *Fragaria glauca*, *Galium boreale*, *Valeriana furfurascens*, *Achillea lanulosa*, *Sieversia ciliata*, *Pseudocymopterus tenuifolius*, *Erigeron eximius*, *Dasystephana Parryi*, *Tium alpinum*, *Thalictrum Fendleri*, *Trifolium repens*, *Danthonia Parryi*, *D. intermedia*, *Koeleria cristata*, *Festuca rubra*, *Agrostis hiemalis*, *Stipa Nelsonii*.

6. *Dasiphora-Valeriana-Delphinium Society*.—A society seen on moist gravelly soil well supplied with water. *Dasiphora fruticosa*, *Valeriana furfurascens*, *Delphinium robustum*, *Fragaria glauca*, *Erigeron eximius*, *Galium boreale*, *Iris missouriensis*, *Caltha leptosepala*, *Pedicularis Parryi*, *Agoseris glauca*, *Pentstemon procerus*, *Achillea lanulosa*, *Tium alpinum*, *Pseudocymopterus tenuifolius*, *Sieversia ciliata*, *Campanula petiolata*, *Aragallus deflexus*, *Dasystephana Parryi*, *Castilleia sulphurea*, *Bistorta bistortoides*, *Potentilla pulcherrima*, *P. Hippiana*, *Aragallus Richardsonii*, *Carex festiva*, *Deschampsia caespitosa*, *Stipa Nelsonii*, *Festuca Thurberi*, *Koeleria cristata*.

7. *Deschampsia-Valeriana Society*.—A society of fine-grained moist soil bordering sedge moors. *Deschampsia caespitosa*, *Valeriana furfurascens*, *Thermopsis divaricarpa*, *Thalictrum Fendleri*,

Castilleia sulphurea, *Potentilla pulcherrima*, *Achillea lanulosa*, *Iris missouriensis*, *Dasystephana Parryi*, *Dasiphora fruticosa*, *Agoseris glauca*, *Carex festiva*.

QUADRAT DETERMINATIONS

In addition to a general study of the meadows, two 2 m. quadrats were examined in detail according to the plan developed by Professor Ramaley in his study of dry grassland (4). Of course such small tracts would not contain all the species in the meadow, but they had more than one fourth of all the meadow plants. TABLE III shows the results of this quadrat study.

TABLE III

SPECIES IN THE QUADRATS WITH APPROXIMATE PERCENTAGE OF GROUND COVERED BY EACH

Species	Percentage of ground covered	
	Quadrat 1	Quadrat 2
<i>Botrychium Lunaria</i>	I	
Grasses	21	3
<i>Carex festiva</i>	2	I
<i>Juncus balticus montanus</i>	3	I
<i>Calochortus Gunnisonii</i>		I
<i>Sisyrinchium angustifolium</i>	I	
<i>Cerastium occidentale</i>	I	I
<i>Delphinium robustum</i>	I	I
<i>Ranunculus cardiophyllus</i>	I	I
<i>Thalictrum Fendleri</i>		II
<i>Arabis glauca</i>		I
<i>Micranthes rhomboidea</i>	I	
<i>Dasiphora fruticosa</i>	I	
<i>Fragaria glauca</i>		8
<i>Potentilla gracilis</i>	I	
<i>Potentilla pulcherrima</i>	4	4
<i>Aragallus Richardsonii</i>	2	
<i>Aragallus deflexus</i>	I	
<i>Thermopsis divaricarpa</i>		I
<i>Tium alpinum</i>	13	II
<i>Pseudocymopterus tenuifolius</i>	2	I
<i>Dasystephana Parryi</i>	I	I
<i>Chondrophylla Fremontii</i>	I	
<i>Castilleia sulphurea</i>		2
<i>Pedicularis Parryi</i>	7	
<i>Pentstemon procerus</i>	4	
<i>Galium boreale</i>		2
<i>Campanula petiolata</i>	I	I
<i>Valeriana furfurascens</i>		I

<i>Achillea lanulosa</i>	I	3
<i>Antennaria anaphaloides</i>	6	
<i>Artemisia Forwoodii</i>	I	
<i>Arnica fulgens</i>		I
<i>Carduus griseus</i>		2
<i>Agoseris glauca</i>	5	2
<i>Crepis perplexa</i>	2	
<i>Taraxacum Taraxacum</i>	I	
Bare ground	15	12

WATER REQUIREMENTS OF VARIOUS PLANTS

The plants of the meadows may be classified according to their usual water requirements or better the amount of moisture in the soils they frequent. Following a plan used by Professor Ramaley in his lectures on ecology, the meadow plants are given the index numbers 5, 6, and 7. Those that grow most commonly in the drier parts of the meadow are numbered 5, those in the wettest parts 7, while the typical mesophytes are numbered 6.

In meadows that are along streams or ponds it is often possible to recognize about three zones, these being characterized by different amounts of moisture in the soil. Some plants are restricted to a single zone while others may grow in two or more but, with few exceptions, not in equal abundance. Certain plants, as *Achillea*, grow well in all three zones but are seldom in great abundance anywhere.

In the systematic list of meadow species given below the relative soil moisture with which the various species are usually associated is indicated by one or more of the figures 5, 6, or 7. The figure which represents the normal condition for the species is italicized.

DURATION OF INDIVIDUAL PLANTS

The majority of the meadow plants are perennials living for many years. Thirteen species, representing nine per cent. of the flora, are annuals. These are *Polygonum Englemannii*, *Alsine baicalensis* *A. longipes*, *Draba nitida*, *Epilobium paniculatum*, *Gayophytum ramosissimum*, *Androsace subulifera*, *Amarella plebeja*, *Chondrophylla Fremontii*, *Collomia linearis*, *Collinsia parviflora*, *Orthocarpus luteus*, *Rhinanthus Crista-galli*. Five species, representing three per cent. of the flora, are biennials. These are *Allium*

recurvatum, *Arabis divaricarpa*, *A. hirsuta*, *Potentilla monspeliensis*, *Lappula floribunda*. Of the annuals and biennials, *Allium recurvatum* is the only one that appears in any great abundance; the others are infrequent.

FREQUENCY OF OCCURRENCE OF DIFFERENT SPECIES

The various species do not occur with the same frequency in each meadow. Some are found in great profusion either locally or widely distributed. Others, which likewise may be either local or widely distributed, are never found abundantly in any place. In the following list frequency is indicated by letters: (a) abundant, (f) frequent, (o) occasional.

SYSTEMATIC LIST OF MEADOW PLANTS IN BOULDER PARK WITH THEIR FREQUENCY AND WATER REQUIREMENTS

OPHIOGLOSSACEAE

Botrichium Lunaria (o) 6, 7

POACEAE

<i>Agrostis hiemalis</i> (f) 6	<i>Koeleria cristata</i> (a) 5, 6
<i>Agropyron pseudorepens</i> (a) 5, 6	<i>Phleum alpinum</i> (f) 5, 6, 7
<i>Agropyron caninum</i> (a) 6	<i>Phleum pratense</i> (f) 5, 6
<i>Agropyron Richardsonii</i> (f) 6	<i>Poa epilys</i> (f) 5
<i>Avena americana</i> (f) 5, 6	<i>Poa interior</i> (f) 5, 6
<i>Bromus lanatipes</i> (f) 5, 6	<i>Poa nevadensis</i> (f) 6
<i>Bromus Porteri</i> (a) 6	<i>Poa rupicola</i> (f) 6
<i>Calamagrostis canadensis</i> (f) 7	<i>Poa subpurpurea</i> (a) 5, 6
<i>Danthonia intermedia</i> (f) 6	<i>Savastana odorata</i> (a) 6, 7
<i>Danthonia Parryi</i> (e) 5, 6	<i>Sitanion longifolium</i> (f) 5
<i>Deschampsia caespitosa</i> (a) 6, 7	<i>Sitanion brevifolium</i> (o) 5
<i>Elymus glaucus</i> (f) 7	<i>Sporobolus asperifolius</i> (f) 6, 7
<i>Festuca confinis</i> (f) 6	<i>Stipa Nelsonii</i> (a) 5, 6
<i>Festuca ingrata</i> (f) 6	<i>Stipa Minor</i> (f) 5, 6
<i>Festuca pseudovina</i> (a) 5, 6	<i>Stipa viridula</i> (f) 6
<i>Festuca rubra</i> (o) 6	<i>Trisetum subspicatum</i> (f) 5, 6
<i>Festuca Thurberi</i> (a) 5, 6	

CYPERACEAE

<i>Carex festiva</i> (a) 6, 7	<i>Carex pennsylvanica</i> (f) 6, 7
<i>Carex lanuginosa</i> (f) 7	<i>Carex utriculata</i> (f) 7
<i>Carex occidentalis</i> (f) 7	

MELANTHACEAE

Anticlea elegans (f) 6

JUNCACEAE

<i>Juncus balticus montanus</i> (a) 5, 6	<i>Juncus saximontanus</i> (f) 7
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ALLIACEAE

Allium Geyeri (a) 5, 6

Allium recurvatum (a) 5, 6

CONVALLARIACEAE

Vagnera stellata (f) 5, 6

CALOCHORTACEAE

Calochortus Gunnisonii (a) 6

IXIACEAE

Iris missouriensis (a) 6, 7

Sisyrinchium angustifolium (a) 6

ORCHIDACEAE

Limnorchus viridiflora (f) 7

POLYGONACEAE

Bistorta bistortoides (a) 5, 6, 7

Polygonum Englemanii (f) 5

Eriogonum subalpinum (f) 5

Rumex densiflorus (o) 7

ALSINACEAE

Alsine baicalensis (o) 6, 7

Arenaria Hookeri (o) 5

Alsine longipes (o) 6, 7

Cerastium occidentale (a) 5, 6, 7

Arenaria Fendleri (f) 5, 6

CARYOPHYLLACEAE

Silene Hallii (o) 5

RANUNCULACEAE

Aconitum ochroleucum (o) 7

Ranunculus affinis (f) 7

Aconitum insigne (o) 7

Ranunculus cardiophyllus (f) 6

Delphinium Nelsonii (f) 5, 6

Thalictrum Fendleri (a) 5, 6, 7

Delphinium robustum (a) 6, 7

BERBERIDACEAE

Odostemon aquaeifolium (o) 5

BRASSICACEAE

Arabis divaricarpa (f) 6

Draba nitida (o) 6

Arabis glabra (o) 6

Draba streptocarpa (f) 6

Arabis hirsuta (o) 6

Erysimum Wheeleri (o) 5

Bursa Bursa-pastoris (f) 5, 6

CRASSULACEAE

Sedum stenopetalum (o) 5

SAXIFRAGACEAE

Micranthes rhomboidea (f) 5, 6

ROSACEAE

Dasiphora fruticosa (f) 6, 7

Potentilla gracilis (f) 5, 6

Drymocallis glandulosa (o) 5

Potentilla Hippiana (a) 5, 6

Fragaria glauca (a) 6, 7

Potentilla monspeliensis (o) 6

Geum oregonense (f) 6, 7.

Potentilla pulcherrima (a) 5, 6

Potentilla filipes (o) 6

Sieversia ciliata (a) 5, 6, 7

FABACEAE

- | | |
|--|--|
| <i>Aragallus Lambertii</i> (a) 5, 6 | <i>Homolobus flexuosus</i> (f) 5, 6 |
| <i>Aragallus Richardsonii</i> (a) 5, 6 | <i>Thermopsis divaricarpa</i> (a) 5, 6 |
| <i>Aragallus deflexus</i> (f) 5, 6 | <i>Tium alpinum</i> (a) 5, 6 |
| <i>Atelophragma elegans</i> (f) 6 | |

GERANIACEAE

- Geranium nervosum* (a) 7

LINACEAE

- Linum Lewisii* (a) 6

MALVACEAE

- Sidalcea candida* (f) 7

HYPERICACEAE

- Hypericum formosum* (f) 7

EPILOBIACEAE

- | | |
|--|--------------------------------------|
| <i>Chamaenerion angustifolium</i> (f) 5, 6 | <i>Epilobium rubescens</i> (a) 5, 6 |
| <i>Epilobium paniculatum</i> (o) 7 | <i>Gayophytum ramosissimum</i> (a) 6 |

AMMIACEAE

- | | |
|--------------------------------|--|
| <i>Heracleum lanatum</i> (o) 7 | <i>Pseudocymopterus tenuifolius</i> (a) 5, 6 |
|--------------------------------|--|

PRIMULACEAE

- | | |
|-----------------------------------|-----------------------------------|
| <i>Androsace subulifera</i> (f) 6 | <i>Dodecatheon radicans</i> (o) 7 |
|-----------------------------------|-----------------------------------|

GENTIANACEAE

- | | |
|---|----------------------------------|
| <i>Amarella plebeja</i> (o) 6 | <i>Dasystephana Parryi</i> (a) 6 |
| <i>Chondrophylla Fremontii</i> (o) 6, 7 | |

POLEMONIACEAE

- Collomia linearis* (f) 6

HYDROPHYLLACEAE

- Hydrophyllum Fendleri* (f) 6

BORAGINACEAE

- | | |
|---------------------------------|-------------------------------|
| <i>Lappula floribunda</i> (f) 5 | <i>Mertensia Bakeri</i> (o) 5 |
| <i>Mertensia viridula</i> (o) 6 | |

RHINANTHACEAE

- | | |
|--------------------------------------|---|
| <i>Castilleja Crista-galli</i> (o) 6 | <i>Pedicularis Parryi</i> (a) 5, 6 |
| <i>Castilleja sulphurea</i> (a) 5, 6 | <i>Pedicularis Grayi</i> (o) 5 |
| <i>Collinsia parviflora</i> (o) 6 | <i>Pentstemon procerus</i> (a) 5, 6 |
| <i>Orthocarpus luteus</i> (o) 5 | <i>Rhinanthus Crista-galli</i> (f) 6, 7 |

RUBIACEAE

- Galium boreale* (a) 5, 6

CAMPANULACEAE

- | | |
|----------------------------------|-------------------------------------|
| <i>Campanula Parryi</i> (f) 5, 6 | <i>Campanula petiolata</i> (a) 5, 6 |
|----------------------------------|-------------------------------------|

VALERIANACEAE

Valeriana furfurascens (a) 6, 7*Valeriana micrantha* (a) 5, 6

CARDUACEAE

Achillea lanulosa (a) 6*Antennaria anaphaloides* (a) 5*Antennaria imbricata* (a) 5, 6*Antennaria microphylla* (f) 5*Antennaria oxyphylla* (f) 5*Antennaria rosea* (f) 5*Arnica fulgens* (f) 6, 7*Arnica Parryi* (o) 6*Artemisia Forwoodii* (f) 5*Artemisia aromatica* (o) 5*Artemisia gnaphaloides* (o) 5*Carduus americana* (f) 6*Carduus Centaureae* (f) 6*Carduus erosus* (f) 6*Carduus griseus* (f) 6*Chrysopsis villosa* (a) 5, 6*Erigeron eximius* (a) 6*Erigeron macranthus* (f) 6*Gaillardia aristata* (a) 5, 6*Helianthella quinquenervis* (a) 6*Rudbeckia flava* (a) 6, 7*Senecio crocatus* (f) 6*Senecio perplexus* (f) 6*Senecio scopulinus* (o) 6*Senecio triangularis* (o) 7*Solidago concinna* (o) 6*Solidago missouriensis* (f) 6

CICHORIACEAE

Agoseris glauca (a) 6*Agoseris Greenei* (f) 6*Agoseris purpurea* (a) 6*Agoseris aurantiaca* (o) 6*Crepis perplexa* (a) 5, 6*Taraxacum Taraxacum* (f) 6

MEADOWS OF THE LOWER MONTANE REGION

A comparison of the meadows of Boulder Park with those of the lower montane region shows that, in the main, the same plants are present but that the predominant plants in the lower meadows become secondary or may even be absent from the meadows of the park. At lower altitudes, introduced plants have supplanted largely the native species and have often become dominant as the following lists show:

Trifolium-Poa Society.—*Trifolium repens*, *T. pratensis*, *Tium alpinum*, *Fragaria glauca*, *Potentilla pulcherrima*, *Achillea lanulosa*, *Juncus balticus montanus*, *Dasiphora fruticosa*, *Phleum pratense*, *Carex festiva*.

Trifolium-Phleum Society.—*Trifolium repens*, *Phleum pratense*, *Trifolium pratensis*, *Campanula petiolata*, *Fragaria glauca*, *Geranium nervosum*, *Tium alpinum*, *Achillea lanulosa*, *Taraxacum Taraxacum*, *Rudbeckia flava*, *Deschampsia caespitosa*, *Carex festiva*.

The higher subalpine meadows differ from the meadows of the montane zone in general appearance. Many of them have a grayer aspect due to the presence of sages and the greater hoariness

of some of the other plants. The plants here are generally shorter and the vegetation resembles dry grassland in its general aspect. Some of the plants found here are common plants of the montane region but they show a tendency toward dwarfing due to the effects of the more severe climatic conditions. In general there is more open or bare ground than in meadows at lower altitudes. Among the prominent plants are *Pseudocymopterus tenuifolius*, *Bistorta bistortoides*, *Micranthes rhomboidea*, *Pedicularis Parryi*, *Achillea lanulosa*, *Rydbergia grandiflora*, *Sedum stenopetalum*, *Cerastium occidentale*, *Erysimum oblancheolatum*, *Artemisia Parryi*, *Dasiphora fruticosa*, *Campanula petiolata*, *Dasystephana Romanzovii*, *Agropyron violaceum*, *Poa crocata*.

The lower subalpine meadows have the dark green color of the montane meadows but the plants are shorter. The number of grasses present is smaller and these cover less ground; therefore they are not so conspicuous as in the montane zone. Among the prominent plants are the following: *Erigeron elatior*, *E. salsuginosum*, *Chrysopsis villosa*, *Achillea lanulosa*, *Castilleia confusa*, *Tium alpinum*, *Castilleia occidentalis*, *Thermopsis divaricarpa*, *Arnica Parryi*, *Solidago missouriensis*, *Campanula petiolata*, *Chamaenerion angustifolium*, *Helianthella quinquenervis*, *Artemisia Parryi*, *Pseudocymopterus tenuifolius*, *Vaccinium caespitosum*, *Senecio Flintii*, *Juncus Drummondii*, *Carex festiva*, *Stipa minor*, *Agropyron pseudo-repens*.

GEOGRAPHIC RELATIONS

The fifty-five most prominent species of the meadow are largely northern plants. One plant only, *Pseudocymopterus tenuifolius*, has a range predominantly southern. Twenty-two range about equally north and south. TABLE IV shows geographic and altitudinal ranges of the predominant plants.

TABLE IV

GEOGRAPHIC AND ALTITUDINAL RANGE OF MEADOW PLANTS

No. of species ranging chiefly to the north.....	32
No. of species ranging chiefly to the south.....	1
No. of species ranging to north and south.....	25
No. of species ranging chiefly higher.....	10
No. of species ranging chiefly lower.....	20
No. of species ranging both higher and lower.....	25

MEADOW PLANTS FOUND IN THE FOREST AND ALONG ROADSIDES

Comparison with a paper by Miss Mary Esther Elder (5) shows that the following plants here listed as meadow plants are also found in Boulder Park along roadsides: *Phleum pratense*, *Koeleria cristata*, *Poa pratensis*, *Festuca rubra*, *Juncus balticus montanus*, *Bursa Bursa-pastoris*, *Potentilla monspeliensis*, *Fragaria glauca*, *Trifolium pratense*, *Trifolium repens*, *Aragallus deflexus*, *Chamaenerion angustifolium*, *Collomia linearis*, *Chrysopsis villosa*, *Solidago concinna*, *Achillea lanulosa*, *Artemisia Forwoodii*, *Artemisia gnaphaloides*, *Taraxacum Taraxacum*.

Comparison with a paper by Miss Katharine Bruderlin (6) shows that the following plants here listed as meadow plants are also found in the Lodgepole Pine forest: *Arenaria Fendleri*, *Cerastium occidentale*, *Draba streptocarpa*, *Erysimum Wheeleri*, *Sedum stenopetalum*, *Drymocallis glandulosa*, *Potentilla pulcherrima*, *Sieversia ciliata*, *Aragallus Lambertii*, *Aragallus Richardsonii*, *Thermopsis divaricarpa*, *Tium alpinum*, *Chamaenerion angustifolium*, *Amerella plebeja*, *Castilleja sulphurea*, *Orthocarpus luteus*, *Penstemon procerus*, *Galium boreale*, *Campanula petiolata*, *Achillea lanulosa*, *Antennaria anaphaloides*, *Antennaria microphylla*, *Antennaria rosea*, *Carduus americana*, *Erigeron macranthus*, *Erigeron eximius*, *Agoseris purpurea*.

SUMMARY

The foregoing is a report of a study of the meadows of a high mountain park at Tolland, Colorado, made during two summer seasons. Descriptions of seven societies are given. Societies of the lower montane region are also indicated and the chief characteristics of the subalpine meadows briefly discussed. A list of the meadow plants of Boulder Park with their frequency and soil moisture index is given.

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